ECONOMIC IMPACT OF GASOLINE SUBSIDY REDUCTION: A SOCIAL ACCOUNTING MATRIX (SAM) APPROACH FOR BANGLADESH

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Student ID: 200612147

THESIS

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ABSTRACT

ECONOMIC IMPACT OF GASOLINE SUBSIDY REDUCTION: A SOCIAL ACCOUNTING MATRIX (SAM) APPROACH FOR BANGLADESH

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This study aims to measure the economic impact of gasoline subsidy reduction on the Bangladesh economy. The study predicts that the Bangladesh economy would experience a significance fall of output; but the fall of income among lower-income households would be less than that for the higher-income households. To achieve social justice and economic efficiency in the whole Bangladesh economy, I also propose a number of policy recommendations.

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I am indebted to Mr. A S M Humayun Kabir, personal secretary (Senior Assistant Secretary) to the ministry of energy and mineral resources, Dhaka, Bangladesh who has provided me the primary data for this study.

I am also grateful to Professor Yuri Mansury who always encouraged and guided me in the technical preparation of this study.

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ABBREVIATIONS

SAM: Social Accounting Matrix

IO: Input Output

BIDS: Bangladesh Institute of Development Studies

BPC: Bangladesh Petroleum Corporation

OECD: Organization Economic cooperation and Development

FY: Fiscal Year

TK: Taka

U.N: United Nation

BEN: Bangladesh Environmental Network

Kwh: Kilo watt hour

CHAPTER-1

1. INTRODUCTION

1.1 Scope of the study:

In Bangladesh, the industrial organization of the petroleum downstream sector since the 1970's has been characterized by an oligopolistic structure, in which a small number of players control the entire market. According to the World Bank country director Mr. Frederick T. Temple (DCCI seminar paper), Bangladesh Petroleum Corporation (BPC) imports crude and petroleum products, the refinery operate without economic considerations, and its value added is most likely negative. According to the Ministry of Power Energy and Mineral Resources related website, there are three subsidiary companies operating/distributing under BPC; namely Padma Oil Company Limited, Jamuna Oil Company Limited and Meghna Oil Company Limited. The three petroleum distribution companies do not compete, and the

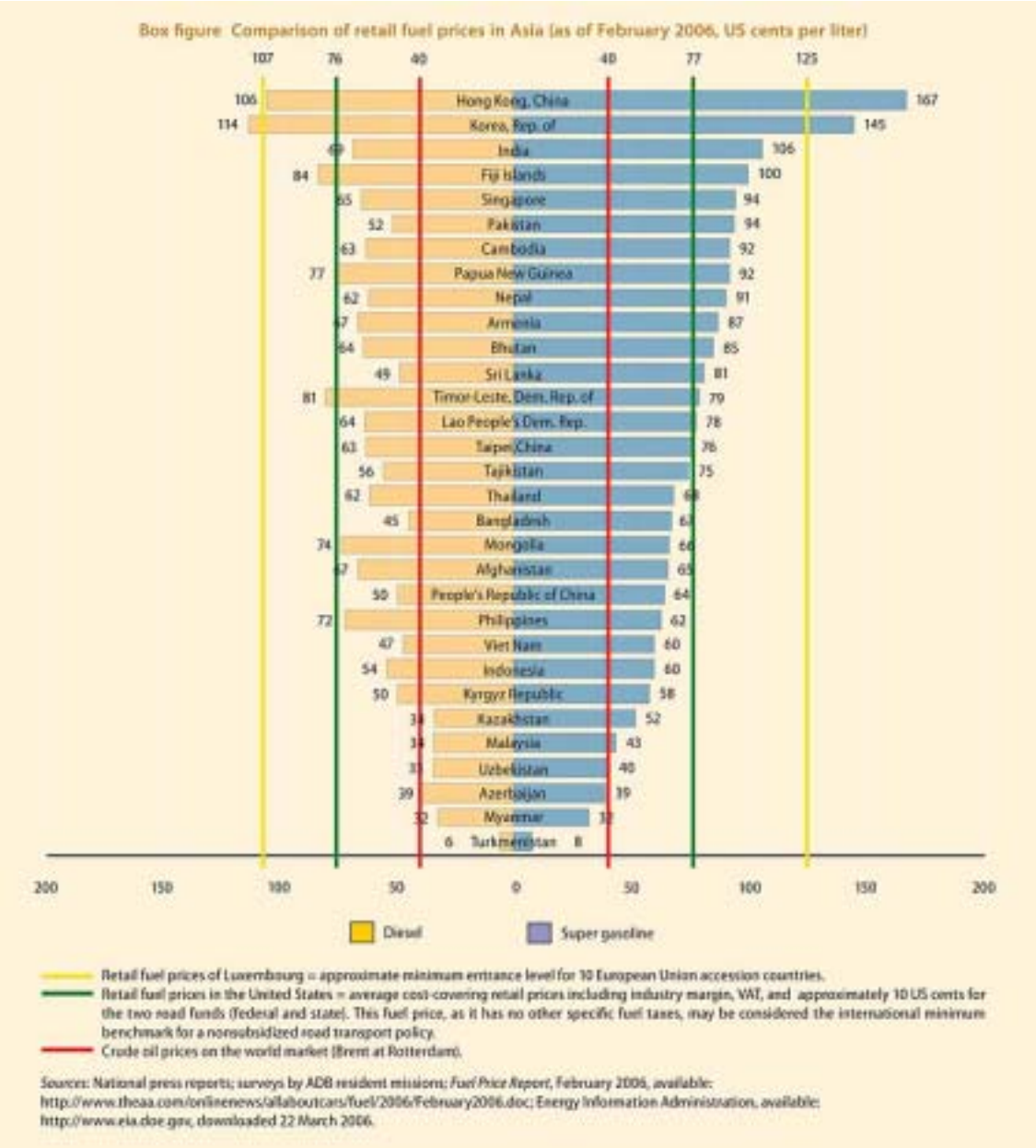
transportation of products is not competitive either. To make things worse, instead of providing a major source of government revenues for the State, the petroleum sector has experienced heavy losses in recent years.

From the point of view of Bangladesh economic development, the petroleum sector losses are undesirable and require special attention. The Bangladesh Government has been selling gasoline in the local market at subsidized rate. As a result of this petroleum subsidy, every year Bangladesh government has to bear a huge amount of foreign currency losses amounting to more than Taka 3000 crores (equivalent US$3 billion). This subsidization policy not only begets economic inefficiency, but also the accumulation of debts that BPC owes to government-owned banks, namely Sonaly Bank, Agrani Bank and Janata Bank. Above all, this inefficiency hits the whole economy, because the three banks are often prevented to provide loan for economically viable investments due to their huge outstanding loan to the BPC. Further, many sectors such as manufacturing, transportation, and agriculture are losing their competitiveness due to the heavily-subsidized gasoline input. At the same time in the public sector, the government enterprises' losses have put huge pressures on the budget, with adverse implications for

macroeconomic stability and resource allocation for social spending, particularly for poverty alleviation.

Bangladesh maintains artificially lowest prices of gasoline among the economies of South Asia, while for example its neighboring country India maintains significantly higher prices of gasoline (figure 1.1). The unintended consequence is the huge amount of imported gasoline smuggled illegally to India across Bangladesh' three-side land border to India, every year, which incurs heavy costs on the Bangladesh economy. The figure below (from the article 'Asian Development Outlook 2006'), which provides an indication of the extent of government subsidies, shows retail prices of transportation fuels—super gasoline and diesel—during the first 2 weeks of February 2006 for selected developing Asian economies.

Figure 1.1: Comparison of retail prices in Asia



Source: Asian Development Outlook 2006: Developing Asia and the World.

Maintaining low gasoline prices have several reasons, both political and social-economic. Bangladesh politicians as anywhere else prefer to avoid unpopular choices. Bangladesh is a low-income country; hence if gasoline prices suddenly increase due to subsidy reduction then the resulting cost-push inflation would hit many sectors, while at the same time the rising cost of living would cause many consumers to suffer. In particular, the agriculture, manufacture, and transportation sectors would be hit the hardest. For example, suppose there is sudden increase in the market price of gasoline, then the production of rice and other crops might be negatively affected, while public transportation costs and other manufacturing goods might go up due to gasoline price hikes. Therefore, the entire economy's output and productivity might decline.

From the outset, many people believe that the cumulative loses brought about by the subsidy reduction could destroy the long-term economic base of Bangladesh. But subsidy reduction does not necessarily have a negative impact on the Bangladesh economy. There are other sources of energy

that could provide a cheaper and more efficient alternative. For example, Bangladesh has substantial stock of natural gases, which also has the potential to produce electricity as well as alternate usage of imported fuels. Bangladesh policymakers and economic planners therefore should devote concentrate on efforts to increase the production of alternative energy in order to reduce the dependency on imported gasoline, and in so doing save their reserves of scarce foreign currency for more productive uses.

The main objective of my thesis study is to measure the economic impact of gasoline subsidy reduction on Bangladesh production sectors of economy using the framework of a Social Accounting Matrix (SAM). Such framework allows me to predict the total loss in economic output due to gasoline subsidy withdrawal policy. SAM extends the Input-Output framework, which measures the total impact of an economic shock by taking into account the indirect feedback effects from inter-industry supply and demand relationships. The equilibrium point reached by successive rounds of feedback represents the total impact. In addition, the social accounting matrix (SAM) also takes into account the induced feedback effects generated by household consumption. A SAM therefore is a comprehensive framework that

calculates the total impact by taking into accounts both inter-industry relationships and households' consumption patterns and income distribution. To the best of my knowledge, there have been very little studies that had been done on this issue using SAM technique. Since gasoline subsidy is one of the important issues faced by the Bangladesh economy, before policy measures are implemented it would be desirable if first the impact of gasoline subsidy reduction can be estimated. I will investigate the scenario in which gasoline prices become fully market-determined due to the elimination of gasoline subsidy. I shall also investigate the impact on household income distribution, in particular whether gasoline subsidy reduction would affect the income of lower income groups relative to the higher income groups. Finally, I will offer policy recommendations to the government that ultimately I hope will promote the use of alternative energy sources.

1.2 Brief summary of Bangladesh economy:

Bangladesh is mainly an agriculture based country, with about three-fifths of the population engaged in farming. Rice is a single dominant product, but jute and tea are the principal sources of foreign exchange from agriculture sector. Although three-fifths of Bangladeshis are farmers,

more than three quarters of Bangladesh’s export earnings come from the garments industry, which began attracting foreign investors in the 1980s due to cheap labor and low conversion cost. In 2002, the industry exported US$5 billion worth of products. The industry now employs more than 3 million workers, 90% of whom are women. A large part of foreign currency earnings also comes from the remittances sent by expatriates living in other countries.

Major impediments to growth include frequent cyclones and floods, inefficient state-owned enterprises, inadequate port facilities, a rapidly growing labor force that cannot be absorbed by agriculture, delays in exploiting energy resources (natural gas), insufficient power supplies, and slow implementation of economic reforms. Badly needed economic reforms are often stalled in many instances by political infighting.

To promote higher GDP growth, investments in both public and private sectors will need to be accelerated. The prevailing political and economic stability has greatly encouraged investment in the private sector. The trend of foreign direct investment is very encouraging.

Since 1990, the country has achieved an average annual growth rate of 5% according to the World Bank, despite the hurdles. The middle class and the consumer industry have seen some growth. In December 2005, four years after its report on the emerging "BRIC" economies (Brazil, Russia, India, and China), Goldman Sachs named Bangladesh one of the "Next Eleven”, along with Egypt, Indonesia, Pakistan and several other countries. Bangladesh has seen a sharp increase in foreign direct investment. A number of multinational corporations, including Unocal Corporation and TATA, have made major investments in the natural gas sector. In December 2005, the Central Bank of Bangladesh projected GDP growth of around 6.5%.

One significant contributor to the development of the economy has been the widespread propagation of micro credit by Muhammad Yunus (awarded Nobel peace prize in 2006) through the Grameen Bank. By the late 1990s, Grameen Bank had 2.3 million members, along with 2.5 million members of other similar organizations.

In order to enhance economic growth the government set up several export processing zones to attract foreign investments, which are managed by the Bangladesh Export Processing Zone Authority (EPZs).

Table 1.1: Bangladesh Economy at a Glance

Area and Population	
Total Area	147,570sq.km.
Total Population	140 million
Basic economic indicators	
GDP-purchasing power parity	$330 billion (2006)
GDP-real growth rate	6.7% (2006)
GDP-per capita: purchasing power parity	$2,136 (2006)
GDP-composition by sector	
agriculture	20.5% (2004)
industry	26.7% (2004)
services	52.8% (2004)
Revenue, excluding grants	23.4% (2004)
Population below poverty line	35.6% (1995-96 est.)
Household income or consumption by percentage share	
lowest 10%	3.9%
highest 10%	28.6% (1996)
Inflation rate (consumer prices)	7% (2006)
Labor force	64.1 million (1998)

Labor force-by occupation	
agriculture	65%
services	25%
industry and mining	10% (1996)
Unemployment rate	40% (includes underemployed) (2002)
Budget	
revenues	$5.9 billion
expenditures	$7.5 billion, including capital expenditures of $NA (2005)
Industries	jute manufacturing, cotton textiles, garments, tea processing, paper newsprint, cement, chemical, light engineering, sugar, food processing, steel, fertilizer
Industrial production growth rate	7.3% (2005)
Electricity-production	16.493 billion kWh (2005)
Electricity-production by source	
fossil fuel	92.45%
hydro	7.55%
other	0% (2005)
Electricity-consumption	15.548 billion kWh (2005)
Electricity-exports	0 kWh (2005)
Electricity-imports	0 kWh (2005)
Industry and international trade	
Agriculture-products	rice, jute, tea, wheat, sugarcane, potatoes, tobacco, pulses, oilseeds, spices, fruit; beef, milk, poultry
Exports	$5.62 billion (2005)
Exports-commodities	garments, jute and jute goods, leather, frozen fish and seafood

Exports-partners	US 23.6%, Germany 13.5%, UK 9.4%, Australia 0.03% (2005)
Imports	$9.6 billion (2005)
Imports-commodities	machinery and equipment, chemicals, iron and steel, textiles, raw cotton, food, crude oil and petroleum products, cement
Imports-partners	India 14.1%, EU 9.5%, Japan 9.5%, Singapore 8.5%, China 13.5%, Kwait8.5%, Australia 1.9% (2005)
Economic aid-recipient	$1.575 billion (2005 est.)
Exchange rates	Taka per US dollar - 69.00 (October 2006), 55.807 (2001), 52.142 (2000), 49.085 (1999), 46.906 (1998), 43.892 (1997)

Sources: Bangladesh Bank annual report 2006, Fact sheet Bangladesh: www.google.com.

1.3 Comparative Energy Use of Bangladesh:

Bangladesh has one of the lowest rates of per capita energy consumption in the world. As is evident from Table 1.0, the 1997 Bangladeshi per capita energy consumption (197 kgoe) was less than the average per capita energy consumption of South Asia for the same period (443 kgoe), and far less than the averages for low income (563 kgoe) and lower middle income (1,178 kgoe) countries. It is also evident that during the 1990s, the energy consumption of Bangladesh

grew at a slower pace (1.0% per annum) than the South Asian average (1.9% per annum).

Table 1.2: Comparison of Energy Use

Economy	Commercial energy use				
	Thousand metric tons of oil equivalent		Per capita		
			kg of oil equivalent		Avg. annual % growth
	1990	1997	1990	1997	1990-97
Bangladesh	20,936	24,327	190	197	1.0
Low income (average)	1,122,683	1,194,696	607	563	-1.2
Lower middle income (average)	2,426,917	2,384,856	1,302	1,178	-1.2
South Asia (average)	435,330	556,496	394	443	1.9
World	8,608,414	9,431,190	1,705	1,692	0.0

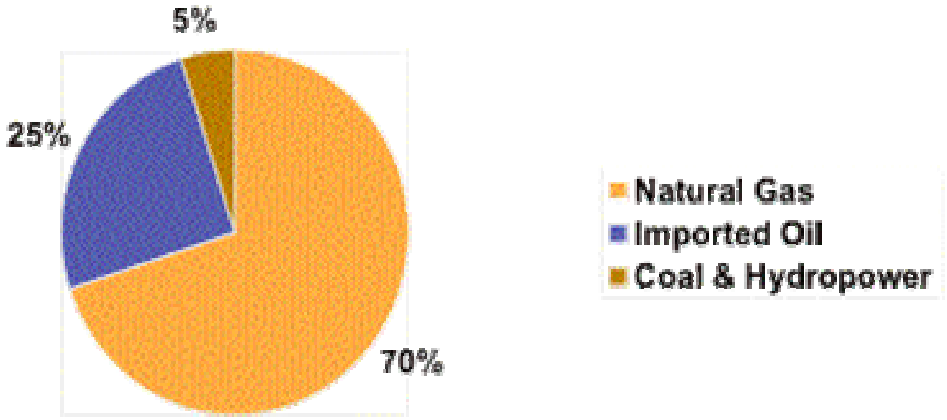
Source: World Bank, "World Development Report 2000/2001: Attacking Poverty," Selected World Development Indicators.

This is because most energy usage is non-commercial, such as biomass fuels, agricultural residues, tree residues, and animal dung etc. Low availability of commercial energy can be a crucial obstacle to a country's economic development. The country has huge unmet demand in commercial energy,

reflecting the energy-starved condition of millions of people. Only 18 percent of the population have access to electricity.

As far as the supply side is concerned, 70 percent of Bangladesh's total commercial energy was provided by natural gas, with the remainder almost entirely provided by imported oil, plus limited amounts of hydropower and coal (Figure 1.2).

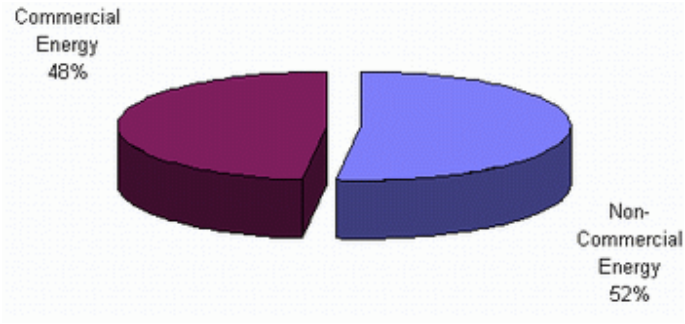
Figure 1.2: Commercial energy consumption trend in Bangladesh



Source: Titas gas transmission and distribution company Ltd, website: www.titasgas.org.bd/usage.htm

Among total energy it has seen commercial and non-commercial energy usage almost equal (Figure 1.3).

Figure 1.3: Total Energy Usage Scenario



Source: Titas gas transmission and distribution company Ltd, website: www.titasgas.org.bd/usage.htm

According to the Bangladesh Petroleum Corporation (BPC), the Bangladesh has imported 3077,529 MT (Octane, Petrol, Diesel, Kerosene and Crude oil) of gasoline in the FY2005-2006. Among them more than 74% is diesel. The imported gasolines are mainly using the transportation, agriculture, industry and household sectors. The sector wise gasoline use is as below:

Table 1.3: Sector-wise gasoline use in Bangladesh economy

Products	**Agriculture**	**Transportation**	**Industry**	**Domestic**
Octane		100%		
Petrol		80%	20%	
Diesel	24%	55%	12%	9%
Kerosene				100%

Source: Bangladesh Petroleum Corporation

In the next chapter, I shall review the relevant literature in my area of study.

CHAPTER-2

2. LITERATURE REVIEW

2.1 Relevant theoretical works on the impact of subsidy reduction:

There are not many studies that have examined the impact of gasoline subsidy reduction on the total economy. But there are studies that have investigated the impact of energy/gasoline price subsidies and taxes.

In recent years ***'The Effect of gasoline Taxes on Highway Fatalities'*** is one, studied by J. Paul Leigh and James T. Wilkinson, published in the *Journal of Policy Analysis and Management*, Vol.10, No.3. 1991.

This research study examined the use of higher gasoline taxes to reduce fatalities associated with reduced air pollution and congestion, decrease dependencies on fossil fuel and reduce budget deficit. The study have used a simple economic model of demand theory that demand for a gasoline is a function of price of gasoline, Income, taste (that is, Q=q (P, I, X). The effects of a gasoline taxes are estimated using a reduced form equation, fatalities are

a function of the price of gasoline tax, income, the mean and standard deviation of vehicle speeds, the percentage of young male drivers, alcohol consumption, the new cars, and average vehicle weight.

The study showed that a large disruption of oil imports would adversely affect the U.S. economy. Externalities arise when these potential costs are not reflected in petroleum and gasoline prices. The research study also showed that a gasoline tax may be effective in reducing dependence on foreign oil.

The study demonstrates that higher gasoline prices lower fatality rates, and it also reduce the dependence on oil imports.

'Gasoline Prices, Welfare and Congestion Tolls' – studied by David Pines and Effriam Sadka, published in the *Scandinavian Journal of Economics*, Vol.86, No.4, 1984. They showed although a price hike of oil would curb wasteful use of oil, thereby enhancing the efficiency of resource allocation. However, a competitive market allocation of resources can be efficient only in the absence of externalities such as traffic congestion.

Using a simple urban model, Pines and Sadka (1981) examined

the effect of gasoline price on the residents of downtown and suburb areas. The study tried to show that an increase in the price of gasoline via higher taxes causes an additional drain on the scarce resources of the composite good. This effect reduces welfare. On the other hand, an increase in the price of gasoline via higher congestion toll also has an effect on suburban residents. But the difference between raising tax and raising toll is that, when toll is raised, the extra tax revenues accrue to the government and thus remain within the city, while when tax is raised, the extra revenues accrue to foreign supplier of gasoline.

'The Two Price System in Energy: Subsidy forgotten' studied by Leonard Waverman, published in *Canadian Public Policy*,Vol.1, No.1,1975.

The study examines the Canadian economy in mid-1973. At that time, the Canadian federal government levied an export tax on oil leaving Canada and maintained domestic Canadian oil prices below the world level. In addition, oil consumers in eastern Canada who rely on imported oil are directly subsidized.

Using survey data of several provinces of Canada, Waverman

found that the two-tiered price system rather than helping Canadians at the expense of foreigners actually redistributes income among Canadians. Some Canadians were made worse off (owner of oil land, shareholders in oil companies); some foreigners were made better off (shareholders in Canadian manufacture firms, purchasers of Canadian manufactured goods). One portion of the complex redistribution of income is examined. For domestic Canadian, a subsidy on direct energy consumption benefits the poor more than the rich. However, the middle class benefits most in some regions while poor consumers in Quebec generally benefit the least.

'General Equilibrium Incidence of Energy Taxation' – John L. Slow, published in *Southeastern Economic Journal*, Vol.51, No.4, 1985.

The research study examined the impacts of a general equilibrium model (with three producing sectors; domestic energy production, energy intensive goods, and non-energy intensive goods, each of these sectors purchase inputs of capital services, labor, and each sector's outputs) that allows for a broad range of possible consequences.

The subsidy causes an expansion of the domestic energy

sector, which draws inputs away from the goods sectors, and since the energy sector is relatively capital intensive, there is an increase in the demand for capital inputs relative to the demand for labor inputs. The price of capital services is bid up relative to the price of labor services, and the subsidy is a greater subsidy to capital income than it is to labor income. For instance, that the study includes although both capital and labor income rise as a result of the subsidy, the **subsidy does not make domestic consumers better off**. The funds to pay the subsidy were being paid by consumers and the efficiency losses that result from distorting the competitive equilibrium. The subsidy also increases profits in the energy sector, but as these are attributed to capital and labor in proportion to their shares of value added, the relative capital intensiveness of the energy sector implies that this is regressive as well.

2.2 Previous empirical studies on the link between gasoline subsidy and sectoral performance:

There are several empirical studies regarding the impact of gasoline price hike on the several counties economy. Among

them, a few remarkable studies are depicted below in brief:

'Fuel Price Subsidies in Gabon: Fiscal Cost and Distributional Impact'- an International Monetary Fund (IMF) paper- prepared by *Moataz El Said and Daniel Leigh on* October 2006.

The paper evaluated the total fiscal cost of gas subsidies using implicit import parity prices, and also analyzed the distribution of the subsidies using household survey data. Finally, authors suggest use of a number of existing programs to provide a more targeted and cost-effective means of protecting the real incomes of lower-income households from the effects of energy price increases.

The main finding of that study is that fuel prices in Gabon benefit from substantial subsidies. The largest fiscal outlays are for the subsidization of diesel (used in large-scale industries and for ground and maritime transportation) and jet kerosene.

Second, it is primarily higher-income households that benefit from the fuel subsidies. The top 10 percent of individuals received about one-third of the total subsidy. Meanwhile, the bottom 30 percent of individuals received

only 13 percent of the subsidies, highlighting that fuel price subsidies are a very costly way to protect the real incomes of the poor.

Finally, the authors argue, that since fuel subsidies are inappropriate on efficiency grounds, it is often desirable to eliminate the subsidies while using the budgetary savings to finance programs designed to protect the real incomes of the poor from energy price increases through increasing expenditure on poverty-reduction projects. For instance the Gabonese authority have already completed a *Poverty Reduction Strategy* in early 2006 that includes a number of projects in the health, education, and infrastructure sectors that could offset the impact of increasing fuel prices on the poor.

'***The Impact of Higher Oil Prices on Low Income Countries and on the Poor'***, a report prepared by UNDP/ESMAP (United Nations Development Program / World Bank Energy Sector Management Assistance Programme, March 2005).

The detail report discusses the impacts of oil price shocks at three levels of economic aggregation:

(i) The **macroeconomic** level, where the link is from oil prices to the balance of payments, to gross domestic

product, and from there to per capita incomes. The report presents the statistical evidence that there is a small but significant negative association between the level of per capita GDP and the ratio of net oil imports to GDP, so that systematically the lowest income oil importers suffer the most from the direct impact of higher oil prices on the balance of payments. Growth and development therefore tend to reduce the vulnerability to such shocks but this effect is small.

(ii) The **mesoeconomic** level of factors which determine the vulnerability of an economy to an oil price shock via its impact on the balance of payments – these factors, which reflect certain aspects of the internal structure of the economies, include the degree of self sufficiency in oil production, the oil dependence of energy use, and the energy intensity of production. The calculation assumes that the higher price lasts a full year, but there are no microeconomic adjustments to the oil shocks, and that the response is entirely by a reduction in absorption. As such, the calculations act as an index of the severity of the shock on different economies, rather than as a forecast as to how the economies will react. Secondly, economies gradually adjust to large changes and this can offset some of the severity of the initial shock. In particular, if the

own price elasticity of demand for oil and oil products is greater than zero, the demand for oil will reduce and so the strain on the balance of payments will be less and a smaller adjustment in GDP will be required. If this effect were strong then countries might well adopt a temporary policy of reducing the level of foreign exchange reserves if any were available, to give time for the internal adjustment to take place. However, many poorer countries do not even have this option and the short run price elasticity of demand tend to be very low, so that the only solution is for the economy to contract.

(iii) The **microeconomic** level (Direct and indirect effects of oil price increases on households), where the impacts of higher oil prices, other prices impacted by the oil prices, and lower GDP, all combine to lower household real income, and where detailed expenditure surveys can throw some light whether the poor are proportionately affected the most by oil price rises.

Households, which are consumers of certain petroleum products (kerosene, LGP and gasoline) and who also purchase other goods whose costs are impacted by oil product prices (diesel for transportation) will feel the effect of higher oil prices in their household expenditure, unless the

government controls product prices and does not let them rise (thus increasing any subsidy element). The study shows that low-income groups are more severely affected than higher income groups. An important component of this total cost of living increase came from impacts on non-fuel expenditures, especially those on transport and food, which are impacted by higher diesel prices. Detailed studies, for Iran and Pakistan, confirmed that the rural poor suffer the most, primarily because of the importance of kerosene for these households.

In countries where petroleum products are subsidized, the impact of higher oil prices will not be directly felt by households, but the worsening of the government's fiscal position will result in less government spending than would otherwise have been possible. Since much of this spending might have benefited the poor, the attempt to protect them by across the board subsidies on petroleum products may be less than successful, and will be unsustainable.

'Removing Energy Subsidies in Developing and Transition Economies'- a conference paper 2000.1.4 of Australian Bureau of Agricultural and Resource Economies, prepared by Matthew Saunders and Karen Schneider is another detailed

study.

The paper explained that governments use energy subsidies mainly to achieve various policy objectives. However, subsidies distort price signals and fail to reflect the true economic costs of supply, hence they lead to inefficient level of production or consumption of the subsidized goods. Since energy consumption also generates pollution, it can contribute to environmental damage.

Analysis based on application of ABARE'S Global Trade and Environment Model (GTEM*) is from the World Bank. This paper considers the likely outlook in 2010 for world energy consumption in the absence of any policy to reduce energy consumption subsidies in developing and transition economies. The study shows the chain of impacts arising from the removal of subsidies as shown below in brief:

- in economies where energy subsidies are removed, the consumer price of energy rise, hence as a result, consumption of energy falls;
- If these economies are also large producers of energy, some domestic production of energy will be diverted to world markets;

- The combination of lower energy consumption in economies that remove subsidies and increased supplies on world markets leads to downwards pressure on world energy prices;
- Energy consumption in order economies rises in response to lower prices;
- Greenhouse gas emission fall in economies that subsidize but is partially offset by a rise in emissions from other economies.

The paper explained that the removal of subsidies have consequences on economic efficiency and growth. These will extend not only to economies that subsidies energy but to others that are affected by the removal of subsidies through price and trade linkage. Since, subsidies are provided as direct transfers from government, so removal of subsidies will reduce the fiscal burden and may lead to increased opportunities for growth-creating investment. Finally, the simulation results indicated that both economies that subsidize energy consumption and other economies benefit when subsidies are removed.

[* GTEM is a multiregional, multisector, dynamic general equilibrium model of the world economy developed to address global change policy issues derived from the MEGABARE model (ABARE1996) and the GTAP model (Hertel1997)].

'Looking Energy Subsidies: Getting Prices Right' an International Energy Agency (IEA) article published in World Energy Outlook, 3rd Quarter 1999 - xi, prepared by Fatih Birol and Jan Horst Keppler.

The article emphasizes identification of the key effects on domestic consumption, carbon dioxide emissions and global energy markets—of energy subsidies in developing and transition countries. The study confirms that pervasive under-pricing of energy resources occurs in eight of the largest countries outside the OECD: China, India, Indonesia, Iran, Kazakhstan, Russia, South Africa and Venezuela. On average, these countries end-use prices are approximately 20% below their opportunity-cost, despite substantial progress in recent years to move towards more rational pricing and market-based policies. These price subsidies result in substantial economic losses and impose burdens on the environment. The detailed quantitative analysis suggests that the removal of energy price subsidies in

these eight countries would:

• reduce primary energy consumption by 13%;

• increase GDP through higher economic efficiency by almost 1%;

• lower CO2 emissions by 16%; and

• produce domestic environmental benefits, including reducing local air pollution.

Finally, they commented that positive effects on a global scale are to be expected. Subsidy removal in all eight countries would cut energy consumption by 3.5% at world level, and world CO2 emissions would fall by 4.6%.

'Energy Subsidy Reform and Sustainable Development: Challenges for Policy Makers' – a workshop report which was held in Bangkok, Thailand on January, 16-17, 2001. Participants were mainly come from Asian countries, including East, West, Central and Southern Asia as well as the Pacific Islands.

The following report highlights key points arising from discussions, especially, need for energy subsidy reforms and its impacts and challenges. The last session synthesized the main issues that have been grouped under

concerns and possible solutions as below:

- While most energy subsidies in Asia are implemented for social (social welfare and equity, protection of lower income and employment concerns) and economic (promote national industry) reasons, participants generally found that they are often not very effective in achieving these goals, rather energy subsidies is negative and put great financial pressure on governments.
- Environmental issues are closely linked to energy subsidies and energy subsidy reform. Subsidies to non-renewable energy encourage inefficiency and over-consumption of energy in most cases, leading to climate change impacts, sea level rise, damages to forestry and bio-diversity, health problems etc.
- Emphasis was also put on the necessity to enhance public awareness on the real price of energy sources and their socio-economic and environmental impacts, as well as on ways to reduce negative effects.

The report explained that all participants agreed on the general need to gradually reform energy subsidies, while accounting for regional-specific factors. The following

challenges were specifically mentioned.

- Necessity to make subsidy systems more effective - in other words, define and implement systems that efficiently reach the targeted people, mostly those with lower income and/or living in remote rural areas with insufficient access to energy services.
- On the environmental side, three main challenges for subsidy reform were identified: conservation of non-renewable energy, improvement of energy structure efficiency, and development of renewable.
- Special consideration was given to the use of energy subsidies to encourage public transportation.

'Energy strategy for Bangladesh: A brief survey with recommendations' - Prepared by the Energy Panel of Bangladesh Environmental Network (BEN).

The panel reviews the energy source options and assesses briefly the state of the energy sector in Bangladesh. The panel points out that there is no comprehensive energy strategy for the country. Efforts that are underway are fragmented, policies are often inconsistent and non-transparent, while legal/regulatory/institutional frameworks are weak and the discourse on energy issues is

polarized even among the experts. Energy source options for Bangladesh are limited. Natural gas is the primary indigenous modern energy source and its reserve is insufficient to meet long-term internal needs. The rural energy sector, which is the single largest component of Bangladesh energy sector (where 80% people live in rural areas and 65% energy is consumption from traditional sources, such as biogas, twigs, animal dung, jute sticks etc), has not received sufficient attention. Proposals for open-pit mining of coal are not well thought out and can lead to severe human dislocations, environmental and ecological disasters. Efforts in utilizing modern renewable energy sources (such as biogas, solar photovoltaic, wind energy, tidal power, hydro-electricity etc) are at an early stage. Despite these difficulties, BEN Energy Panel is confident that Bangladesh can make significant strides in the energy sector.

The panel recommends that a comprehensive energy strategy be developed to address the above shortcomings. Energy policies must be arrived at with a national dialog, free from vested agendas and external interference. These policies must utilize international best practices, and promote greater self-reliance in energy exploration,

development and utilization. The panel strongly recommends postponement of any decision to exploit coal reserves, especially by open-pit mining, until the associated adverse impacts are clearly understood and appropriate technological, legal and institutional frameworks can be deployed to mitigate them.

'The economics of oil price adjustment in Bangladesh',- Sadiq Ahmed, published in The Daily Star web page, vol. 5,6,7 Num. 495,496,497 on Oct.16,17,18, 2005.

The writer explained that between July 2003 and August 2005, the international crude oil prices increased by more than 200 percent, accelerating from around $26 per barrel to over $60. In advanced economies like the OECD countries, oil prices are market based and international price changes are passed through to consumers on a regular basis. But in developing countries like Bangladesh, where domestic oil prices are policy determined due to price control, this has posed a serious political and economic dilemma. Politicians and consumers do not want to see any increase in domestic prices. They argue that higher domestic oil prices will fuel inflation and hurt the poor. Thus, much of the debate seems to emerge from a poor knowledge of the facts and the possible consequences of different policy options,

including the option of not adjusting. The author argued that as external adjustment the immediate implications of the rise in international oil prices for the Bangladesh economy is offsetting increases in exports or reduction in other imports, the trade balance would have worsen and putting pressure on the exchange rate and the reserves.

And as internal adjustment the balance of payments is adjusted through a combination of exchange rate depreciation, increase in domestic interest rates, and a cut in public spending. First, the government can cut spending somewhere else. Since most current spending such as wages, pensions, interest payments and subsidies are fixed in the short term, this will require cuts in development spending (e.g. health, education, roads, water supply etc.). Second, the government can raise taxes. Given the history of weak tax collection effort, this is not a practical option in the near term [for instance, Bangladesh has one of the lowest taxes to GDP ratio (8.5 percent of GDP) in the developing world]. Third, the government can run higher deficits by borrowing from the private sector or requiring public banks to finance the gap in the BPC. Fourth, the government can allow BPC to pass on the cost of higher oil imports to consumers. Finally, a combination of

these various instruments is also possible.

The author argues that not raising oil prices is a bad choice in the sense that other hard choices would have to be made with serious adverse implications for growth, inflation and poverty reduction. Based on the standard theory of public finance, the most efficient solution is to pass on the increase in the oil price to consumers. Since oil is a private good, it is most efficient that consumers pay the market price for the product. With higher relative price of oil, consumers will find ways to conserve its use. Any other solution is likely to be inefficient (consumers will tend to consume too much oil at these artificially low prices), inequitable (violates the consumer pays principle for a private good), and the adverse consequences of other ways of adjustment (increase in interest rate, money creation leading to inflation, cutbacks in development spending) could outweigh any political gains from not adjusting domestic oil price.

Although the above studies are not completely related to my case, these studies are useful in describing the potential the social and economic impact of a gasoline price subsidy decrease. Subsidy reduction clearly will raise the price of gasoline, which may tend to reduce other factors such as

pollution, accidents, dependence on foreign oil and may induce the production of alternate source of domestic sources of energy. The above studies explained details related to gasoline issues in a descriptive way, but they did not measure the total impact on a region quantitatively. This paper will attempt to quantify the total impact of these reductions of gasoline subsidy on the overall Bangladesh economy.

CHAPTER-3

3. DATA

3.1 Description of the Bangladesh Social Accounting Matrix (SAM) data.

For this study we use the Social Accounting Matrix (SAM) data for Bangladesh 1993-94. The SAM is based on the 1993-94 Input- Output (I-O) Table (BIDS 1998); 1993-94 national accounts data, 1995-96 labor and household surveys, and information from an existing SAM for 1993-94. This SAM distinguishes ten factors of production with eight different types of labor (by level of education and gender), one type of capital, and one type of land. The SAM contains 10 agricultural sectors and 19 manufacturing sectors, out of 43 sectors in total. It also differentiates between twelve socio-economic groups, allowing detailed analysis of household welfare and poverty.

Disaggregation of the production and commodity accounts:

The main data source that forms the basis of the 1993-94 SAM is the 1993-94 I-O Table. The production of goods and the supply of commodities to domestic and export markets

make up the largest part of the SAM. The 1993-94 SAM distinguishes between 43 productive activities, which are an aggregation of the 79 activities in the 1993-94 I-O Table. Of the 43 productive activities defined in the SAM, 10 are agricultural activities, 19 are manufacturing activities, and 14 are service activities. However, the SAM has only 42 commodities. In most cases, the activity is the sole producer of its respective commodity. The only exception is the commodity paddy, which is produced by two activities (associated with different production technologies representing *aman* and *boro* cropping). 'Aman' constitutes about 44 percent of total rice production, is rain-fed and slightly more labor intensive than 'Boro', which is an irrigated crop with higher fertilizer inputs and higher yields. The SAM also distinguishes several textile sectors and separates out the ready-made garment sector, for its strategic importance in export. For this study I break down production and activities into two categories: aggregated and disaggregated.

Table 3.1: Aggregated and disaggregated activities and commodities in the Micro SAM 1994-95

	Disaggregated Activities		Aggregated Activities	Disaggregated Commodities	Aggregated Commodities
1	AAMAN	Aman rice		CPADDY	
2	ABORO	Boro and Aus rice	AGRAINS	CPADDY	CGRAINS
3	AGRAINS	Grains		CGRAINS	
4	AJUTE	Jute		CJUTE	
5	ACOMCROP	Commercial cr ps	ACROPS	CCOMCROP	CCROPS
6	AOTHCROP	Other crops		COTHCROP	
7	ALIVESTO	Livestock		CLIVESTO	
8	APOULTRY	Poultry	ALIVSTOK	CPOULTRY	CLIVSTOK
9	AOTHFISH	Fishing		COTHFISH	
10	AFOREST	Forestry	AFORESTRY	CFOREST	CFORESTRY
11	ARICEMIL	Rice milling		CRICEMIL	
12	AATAFLOU	Ata & flour		CATAFLOU	
13	AOTHFOOD	Food	AFOODPROC	COTHFOOD	CFOODPROC
21	ATOBP	Tobacco		CTOBP	
14	ALEATHER	Leather		CLEATHER	
15	AJUTETEX	Jute textiles		CJUTETEX	
16	AYARN	Yarn		CYARN	
17	AMILCLOT	Mill clothing	ATEXTILES	CMILCLOT	CTEXTILES
18	ACLOTH	Clothing		CCLOTH	
19	AGARMENT	Garments		CGARMENT	
20	AOTHTEXT	Other textiles		COTHTEXT	
22	AWOODP	Wood & paper		CWOODP	
23	ACHEM	Chemicals		CCHEM	
24	AFERTI	Fertilizers	ACHEMICALS	CFERTI	CCHEMICALS
25	APETROP	Petrolem		CPETROP	
26	ACLAYP	Clay		CCLAYP	
27	ASTEEL	Steel		CSTEEL	
28	AMACHIN	Machinery	AOTHIND	CMACHIN	COTHIND
29	AMISCIND	Other industries		CMISCIND	

3 0 AURBBUIL	Urban building		CURBBUIL	
3 1 ARURBUIL	Rural building	ACONSTRUCTON	CRURBUIL	CCONSTRUCTION
3 2 ACONST	Construction		CCONST	
3 6 AHOUS	Housing		CHOUS	
3 3 AUTILITY	Electricity & water		CUTILITY	
43 ACOMM	Communications	ACOMMUNICATIONS	CCOMM	CCOMUTN.
34 ATRADES	Trade	ATRADE	CTRADES	CTRADE
3 5 ATRANSS	Transport	ATRANS	CTRANSS	CTRANS
3 7 AHEALTH	Health		CHEALTH	
3 8 AEDU	Education		CEDU	
39 APUBADM	Public administration		CFINS	
40 AFINS	Financial services	ASERVICES	CPUBADM	CSERVICES
41 AOTHS	Other personal services		COTHS	
42 AHOTEL	Hotels		CHOTEL	

Factors:

The 1993-94 SAM distinguishes three factors of production: labor, land, and capital. In this study, we aggregate categories of labor (labor is disaggregated into eight categories) that were previously distinguished by gender and education into one category as follows:

Table 3.2: Categories of factors of production

Disaggregated labor category	Aggregated category
1 Female labor with no education 3 Female labor with low education	**Flledu**
2 Male labor with no education 4 Male labor with low education	**Mlledu**
5 Female labor with medium education 7 Female labor with high education	**Flhedu**
6 Male labor with medium education 8 Male labor with high education.	**Mlhedu**

Institutions:

Households:

The 1993-94, Micro SAM distinguishes three factors of production: labor, land, and capital. Information on GDP at factor costs for each sector is taken from the 1993-94, I-O Table. Employment and wage data are both derived from the 1995-96 Labor Force Survey (LFS) and used to compute labor value-added. Value-added to land (in the agricultural sectors) and capital (in the non-agricultural sectors) for each sector is calculated residually as the difference between sectoral GDP and total labor value-added. For simplicity of analysis the twelve household groups are aggregated as below:

Table 3.3: SAM aggregated household groups

SAM Household Groups	Aggregated Groups
Agriculture landless	Landless
Agriculture marginal	Marginal
Agriculture small	Small
Agriculture large	Large
Non-agriculture poor female household	NAPFM
Non-agriculture poor male household	
Non-agriculture rich female household	NARFM
Non-agriculture rich male household	
Urban no education	Illitera
Urban low education	LowEdu
Urban medium education	MedEdu
Urban high education	HighEdu

3.2 Structure of sectoral production / share in the Bangladesh economy:

Table 3.4: GDP - composition by sector

Year	Sectors			Total
	Agriculture	Industry	Service	
1999	30	17	53	100
2000	30	18	52	100
2001	35	18	52	100
2002	_	_	_	_
2003	21.7	26.6	51.7	100
2004	20.5	26.7	52.8	100
2005	21	27	52	100

Sources:USAID,Bangladesh:www.usaid.gov/bd/Bangladesh.htm/; CIAworldfactbook2006.

The contribution of the service sector to the GDP is more than half for several years and it remains almost same, but the share of agriculture sector is gradually decreasing and the share of industry sector is gradually increasing for last several years.

3.3 Initial injection of data specifying sectoral use of petroleum input (Primary data):

The Bangladesh Petroleum Corporation (BPC*) imports three types of petroleum product-refined octane (super gasoline), petrol, diesel, and kerosene as well as crude oil. Last fiscal year (FY: July ’05-June ’06), BPC imported both refined and crude oil worth Tk.13083.46 crore ($130.8346 billion). Total revenue was Tk.9905.63 crore ($99.05 billion). Therefore, total loss or subsidy by the government was Tk.3177.83 crore ($31.7783 billion). According to the BPC, Bangladesh government has been providing subsidy on the price of **diesel** only. From the sector-wise gasoline use (Appendix-A) and table 1.1) information, the sector-wise total subsidies are given below:

Table 3.5: Sector-wise diesel subsidy in Bangladesh economy

Sectors	**Subsidy (Tk.crore)**	**Subsidy (Tk.billion)**
Agriculture	762.6792	76.26792
Transportation	1747.8065	174.78065
Industry	381.3396	38.13396
Household	286.0047	28.60047
Grand Total	**3177.83**	**317.783**

Source: Converted from BPC data.

These subsidy amounts are the initial shocks or negative **injections** of our impact analysis.

*BPC is a government autonomous body that has the sole authority to import and distribute the gasoline.

CHAPTER-4

4. METHODOLOGY

4.1. Social Accounting Matrix (SAM) and multipliers:

The Social Accounting Matrix (SAM) method of economic analysis was originally developed by Richard Stone (‘A system of national accounts’ as a U.N report; published in 1952). Pyatt and Thorbecke (1976) further formalized the SAM, and showed how it could be used as a conceptual and modular framework for policy and planning purposes. Thus, SAM was based on a system of national accounts and greatly improved the basis for empirical economic analysis. Its main purpose is to measure the total impact of an economic shock. Although SAM contains I-O structure for each industry, SAM also emphasizes income distribution among households differentiated by occupation, income levels, gender, ethnicity etc. In I-O model, final consumption and household income are treated as exogenous variables; that is, I-O contains only inter industry transactions. In SAM, household income and final consumption are treated as endogenous variables, so SAM feedback effects are larger due to the inclusion of the distribution of income (both

factorial and household income distribution), as well as other factors such as exports, imports, government transfers to households (welfare programs), investments, and taxes.

The SAM framework can be used as both a database and as a basis for modeling. For modeling and analysis of the impact analysis one question to address when using the SAM as a conceptual framework is which accounts should be considered exogenous and which endogenous. It has been customary to consider the government, the rest of the world and the capital accounts as exogenous and the factors, other institutions, (households and companies) and production activities' accounts as endogenous. Therefore, our study also follows this convention regarding the endogenous and exogenous accounts for impact analysis.

The SAM as a database is defined as the matrix ***Ti,j*** **(**a payment from account *j* to account *i*) of monetary flows, representing receipts and expenditures of all economic agents. Following the convention of double-entry bookkeeping, total receipts and total expenditures of a particular agent *i* have to be equal, *i.e.*, respective row and column sums are balanced:

$$y_i = \sum_j T_{i,j} = \sum_j T_{j,i}$$

where y_i denotes the total outgoings (or incomings) of account j. Dividing every cell entry of the flow matrix T by its respective column total generates a matrix A of column SAM coefficients:

$$\boldsymbol{A}_{i,j} = \frac{T_{i,j}}{y_j}$$

In matrix notation it follows that:

$$\boldsymbol{y = A\ y + d,}$$

where d is the exogenous account, which is the source of shocks and injections into the (regional) economy. In the next step, the SAM coefficients are subtracted from the identity matrix (I), which consists of all zeros except the diagonal from the upper left corner to the lower right corner, where each element is a '**1**'. The resulting matrix (I-A) is then inverted, giving the equilibrium matrix $\mathbf{(I-A)}^{-1}$. This is the **SAM matrix of multipliers**, which is used to calculate the total impact of an economic shock. If a certain number of conditions are met – in particular, the existence of excess capacity and unemployed or underemployed labor resources – the SAM framework can be used to estimate the effects or impact of exogenous changes and injections. As long as excess capacity and a labor

slack prevail, any exogenous change in demand can be satisfied through a corresponding increase in output without having any effect on prices. Thus, for any given injection (positive or negative) anywhere in the SAM, influence is transmitted through the injection on the endogenous accounts, that is, the total outputs of the different production activities and the incomes of the various factors and socioeconomic groups are estimated through the multiplier process.

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The system of equations can be represented in a matrix format,

$$\mathbf{(I-A)\ y = d},$$

$$\text{Or, } \mathbf{y} = \mathbf{(I-A)}^{-1}\ \mathbf{d},$$

Now, for exogenous shock or injection into the economy the total impact can be estimated by,

$$\Delta Y = \mathbf{(I-A)}^{-1}.\ \Delta d$$

To find the impact of a shock given the multiplier matrix, the dollar value of the shock is multiplied by the column

of the affected accounts. Thus, for instance, in a two sector economy with industries A and B, if one dollar is injected into industry B, then one would be multiplied by all multipliers in column B of the $\mathbf{(I-A)}^{-1}$ matrix. The impact on industry A would then be the first number in the column, and the impact on industry B the second.

It is important to note that the SAM model operates under a set of assumptions that must be acknowledged. **First**, the model assumes that the aggregation of firms into broad sectors is a meaningful notion. In practice, this can be fairly ambiguous. **Second**, the framework assumes that there is a linear production function for every industry. Thus, there are no economies of scale; that is, each addition dollar of output requires exactly the same amount of input. **Third,** SAM employs a purely demand driven approach, which ignores supply constraints. **Fourth**, prices are assumed constant. **Finally**, SAM assumes that the technical coefficients will remain constant at all times. In addition, this study uses a single-region framework, which is only appropriate when there are not significant feedback effects to and from neighboring regions.

CHAPTER-5

5. IMPACT ANALYSIS

5.1 Estimating the impact of gasoline subsidy reduction on sector-wise production:

The study examines the impact of the elimination of the gasoline subsidy (mainly diesel) of Tk.317.58 billion on the Bangladesh economy. I found that the total output loss of Bangladesh economy would be Tk.6080.772 billion, which is twenty times higher than the subsidy amount (table 5.1). Three main sectors such as agriculture, transportation, and industry, where diesel is used directly would have the loss of output Tk.1352.035 billion including direct, indirect and induced impacts (table 5.2). In addition, there would be significance loss of household incomes in the amount of Tk.1014.8808 billion.

Table 5.1: Impact of gasoline subsidy reduction on the economy

AGRAINS	202.378
ACROPS	105.103
ALIVSTOK	146.213
AForest	51.384
AFOOD	286.019
ATEXTILES	89.465
ACHEMICALS	75.087
AOTHIND	30.310
ACONSTRUCTION	102.772
ACOMMUNICATION	35.830
ATradeS	221.137
ATransS	366.085
ASERVICES	185.628
CGRAINS	178.353
CCROPS	95.923
CLIVESTOK	124.911
CForest	41.818
CFOOD	280.781
CTEXTILES	96.570
CCHEMICALS	117.709
COTHIND	65.555
CCONSTRUCTION	102.772
CCOMMUNICATION	40.295
CTradeS	221.354
CTransS	191.307
CSERVICES	186.234
Flledu	205.558
Mlledu	196.154
Flhedu	27.886
Mlhedu	19.052
LAND	146.430
CAPITAL	392.462
Landless	5.879
Marginal	58.329
Small	128.106
Large	152.324
NAPFM	100.650
NARFM	78.991
Illitera	46.654

LowEdu	67.331
MedEdu	117.154
HighEdu	259.463
CORP	392.462
ITAX	27.773
TAR	17.123
Grand Total	**6080.772**

Agriculture: According to the subsidy information (Table-3.3) agriculture sector receives Tk.76.268 billion. Our study predicts the withdrawal of that subsidy would result in the loss of Tk.505.075 billion in the agriculture sector. There is a significant induced impact of subsidy reduction, which is worth Tk.392.5007 billion, whereas the direct and indirect impacts are Tk.76.268 and Tk.36.307 billions, respectively. The reasons may depict as subsidy reduction would the cause of increase of cost of production which may lead the increase of price of agriculture products. According to the classic demand theory the increase of price yield the decrease of demand, overall results are decrease of production and fall of income.

Table 5.2: Impact of diesel subsidy withdrawal from three sectors

Sectors	Direct	Indirect	Induced	Total
Agriculture	76.268	36.307	392.5007	505.075
Industry	38.134	33.187	409.5573	480.879
Transportation	174.781	17.055	174.2455	366.081

Transportation: Transportation sector receives the highest amount of subsidy that amounts to Tk.174.781 billion (55% of diesel subsidy, from table 3.3). A withdrawal of that subsidy would yield Tk.366.081 billion loss of output in the transportation sector. The result shows there is only Tk.17.055 billion loss of output as indirect impact, which is comparatively lesser impact than the induced impact which constitutes Tk.174.2455 billion (Table-5.2). For instance, transportation sector can pass through the extra cost/increased cost to the end-user easily, therefore, increase of fuel cost the ultimate results are the increase of cost of production and the decrease of household real income for the whole economic activities indeed.

Industry: Industrial sector receives a subsidy Tk.38.134 billion. This study shows a withdrawal of that subsidy would result in Tk.480.879 billion loss of output for the whole industrial sector. There is also a strong induced

impacts of the subsidy reduction which is estimated Tk.409.5573 billion, whereas, the direct and indirect impacts are Tk.38.134 and 33.187 billions respectively. Due to the shortage of electricity in Bangladesh, many manufacturing industries additionally have to use diesel based electric generator, and a portion of national electricity is also generated by fuel. The subsidy reduction on the fuel may cause of higher cost of production, which may lead price hike, finally, may cause of the reduction of output and income. Therefore, in the industrial sectors' induced impact is proportionately higher than other sectors.

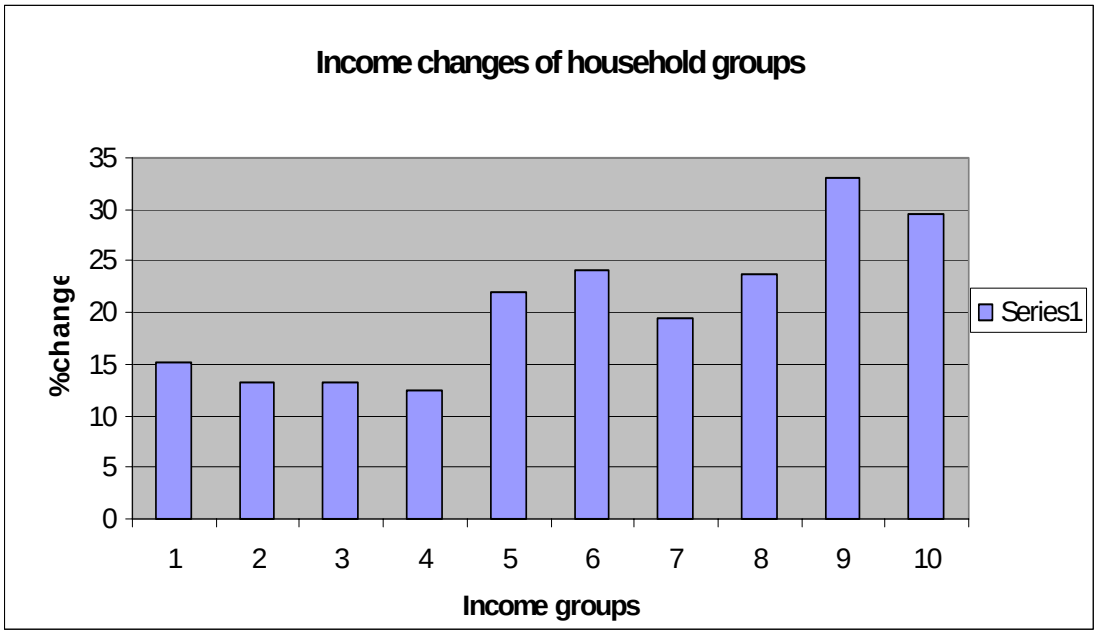
Household Income Distribution: The table 5.3 and figure 5.1 below show the income share of different household groups before and after impacts. There is a significance effect has been found on the loss of household incomes. The study predicts a withdrawal of from diesel subsidy would have the loss of household income Tk.1014.88 billion. There would 15 percent or around 15 percent decrease in income of agriculture household income groups (such as landless, marginal, small, and large) each; On the other hand, there would have more than 20% decreased in income non-agriculture household groups (NAPFM, NARFM LowEdu MedEdu

HighEdu) each. Among them urban medium and high educated household groups' income share would decrease significantly which constitute 33 percent and 29.52 percent respectively (Table below).

Table 5.3: Income Distribution of Households

Household groups	Initial(SAM) Income	Total Income after Impact	Changes	Income share (%) of household		% change in Income
				After impact	Before Impact	
Landless	6.925	5.879	1.046	0.579	0.525	15.101
Marginal	67.227	58.329	8.898	5.747	5.100	13.236
Smal	147.622	128.106	19.516	12.623	11.200	13.220
Large	173.962	152.324	21.638	15.009	13.198	12.438
NAPFM	128.956	100.650	28.306	9.917	9.784	21.950
NARFM	104.011	78.991	25.020	7.783	7.891	24.055
Illitera	57.968	46.654	11.313	4.597	4.398	19.517
LowEdu	88.363	67.331	21.032	6.634	6.704	23.802
MedEdu	174.865	117.154	57.712	11.544	13.267	33.003
HighEdu	368.181	259.463	108.71	25.566	27.933	29.528
Total	1318.079	1014.8808				

Figure 5.1: Income changes of different household groups



The study predicts that the income inequality among different household income groups would fall. The figure below shows that after the withdrawal of gasoline subsidy from the economy, the share of income of agriculture and non-agriculture poor female-male (NAPFM) household groups would increase, on the other hand the share of income of the urban household group including non-agriculture educated household income groups' would decrease. That means as a result of the withdrawal of gasoline subsidy, the income of the poor agriculture households would fall

less than the income of the rich urban households.

Figure 5.2: Income distribution among different household groups

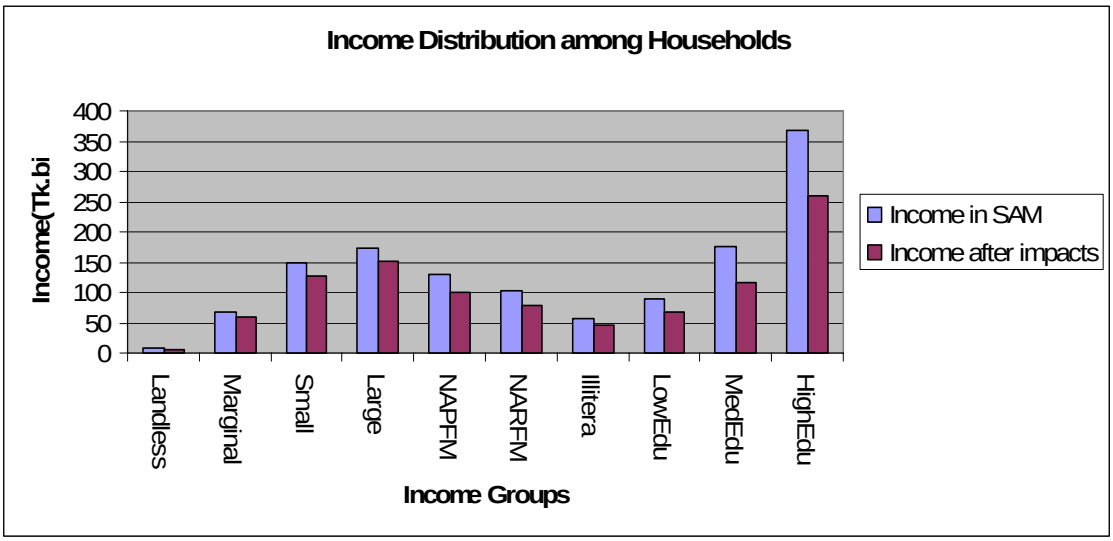


Table 5.4: Coefficient of Variances

Coefficient of Variances (CVs)	
Before impact	After impact
0.7102483	**0.6549234**

5.2 Alternative scenario: natural gas as an alternative source of energy:

Natural gas is the only significant source of commercial

energy in Bangladesh. It has shown before (fig.1.1) that among total commercial energy consumption of the country, the seventy percent contribution from natural gas and 25 percent by imported oil, and total installed electricity is generated by thermal (mainly natural-gas-fired), but unfortunately Bangladesh still has the lowest electricity generation per capita in the world, at about 155 kilowatt-hours (kwh) in 2005.

Bangladeshi natural gas production began in 1960 from the Chattak Field. There is much uncertainty and debate about the level of natural gas reserves in Bangladesh. Estimates from Petrobangla put net proven reserves at 15.3 Trillion cubic feet (Tcf)*as of mid-2004. The US Geological Survey has estimated that Bangladesh contains an additional 32.1 Tcf *in additional "undiscovered reserves". This suggests that Bangladesh has the potential to become a major gas producer (as well as supplier to the vast potential market in neighboring India) at some point. Bangladesh also could use its natural gas resources to power vehicles by converting vehicles engine into compressed natural gas (details later) to help alleviate pollution problems, to produce electricity, petrochemicals, and fertilizers, which it also could use both within the country as well as for

export.

Natural gas exploration and production is dominated by two state-owned companies - Sylhet Gas Fields Ltd. and Bangladesh Gas Fields Co. Ltd all of which are subsidiaries of Petrobangla. In the gas sector these national companies discovered maximum gas fields and have been producing almost 70 percent of gas. However, fearing a short-fall and citing lack of funds and technology, the government has awarded production sharing contacts (PSC’s) to several international oil companies (IOC’s) with a 70:30 split of the gas produced. The country buys IOC share with hard currency but sells it to the local market at a discounted price. This has raised questions on the wisdom of the PSC’s as a net economic benefit to the country.

Since Bangladesh has a considerable reserve of natural gas, it has the potential to become a major gas producer (as well as supplier to the vast potential market in neighboring India) at some point. Bangladesh also could use its natural gas resources to power vehicles by converting vehicles engine into compressed natural gas (details next) to help alleviate pollution problems, to produce more electricity to meet the increasing demand and electricity shortage. Natural gas is one of the main raw materials for

many products such as fertilizer, petrochemicals etc, which it also could use both within the country as well as for export. Export of high value-added manufacturing products should be a priority as far as gas use is concerned rather than raw gas export concept. Currently, 70 percent of the domestic natural gas supplies are for power generation, while the rest is used for fertilizer production as well as for other industries and households.

Thus, by giving proper attention on natural gas exploration and production while allowing market mechanisms to determine its efficient allocation and reasonable use, Bangladesh may accelerate its economic growth and reduce the dependency on imported oil substantially.

*sources of information figures: Energy Information Administration (eia)- an official statistics from the U.S government; July, 2006; **www.eia.doe.gov/**, The energy panel of Bangladesh environment network, 2006.

CHAPTER-6

CONCLUDING REMARKS

6.1 Conclusions:

In many developing countries like Bangladesh, gasoline subsidies are implemented to pursue social (equity, protection of lower income, and employment concerns) and economic (promote national industry) goals. However, there is a lack of specific studies examining whether these subsidies actually yield social and economic benefits for the economy for the long term. What are the alternate ways to offset the possible impacts of the shock, and which household groups are vulnerable to shocks due to a gasoline subsidy reduction?

Using a SAM framework, my study has found that gasoline subsidy (mainly diesel subsidy) elimination policy may cause a significant fall of total output. An elimination of subsidy Tk.317.58 billion (by a year) can cause a fall of income Tk.5764.082 billion in the whole economy. The sector-wise breakdown impacts also show that the subsidy elimination policy would yield significant induced impacts.

Indeed, oil not only is used as a direct consumption item (such as motor cars) but also as an input in the production chain (irrigation, electricity, transport). As a result, the secondary effects through the input-output processes could lead to a cause of price hike for other commodities.

At the same time, gasoline price hike may also cause the fall of income of different household income groups. My study predicts that under a subsidy elimination scenario, the income of all agriculture household groups as well as non-agriculture poor household groups would decrease proportionately less than that of the urban rich household groups.

6.2 Fuel Economics and Policy Recommendations:

The negative effect of gasoline subsidy elimination might be especially hard for low-income groups. Especially in agriculture sectors where diesel is used for farming directly, the cost of production may increase. In the transportation sector where fuel is also used directly, it may indirectly hit other manufacturing sectors that heavily depend on transportation inputs. The relevant policy response is therefore to address whether protection of real

income of low income groups as well as to attain the long term economic efficiency for the whole economy with maintaining the macroeconomic stability and sustainable development. Here, I propose sectoral policy measures below:

Agriculture: Bangladesh economy is mainly agriculture based, where more than two-thirds people are engaged in agriculture sector. From Agriculture Ministry sources (published in newspaper: The Independent; 22.10.2006) said it requires about Tk.775 crore (TK77.5 million) to cover some 94 lakh (0.94 million) farmers using the fuel for irrigation. The same source shows it takes Tk.17,199 to irrigate a hectare of land with diesel-run pumps compared to only Tk.5,785 with electric pumps, as the government gives farmers a 30 per cent power rebate as subsidy for irrigation. Hence, as a **long run solution** the government can provide electricity for farmers, because the cost of electricity-run pumps is less than the cost of diesel-run pumps. This scheme would be better for both sides, as government can save foreign currency while farmers would be able to get real protection from the threat of decreasing income. Not only that, if electricity can be available in the rural area, then there would be possibility to

establishment of many small and cottage industry which could be the real acceleration of the economy. As a **short run** policy, I recommend a scheme to distribute diesel subsidy among small farmers through the involvement of people's representatives at the union parishad level (village), upazila (sub-district) and district-level officials, besides field officers of the Department of Agricultural Extension (DAE). Their involvements will be necessary in identifying farmers, distributing the subsidy money, and monitoring the entire process.

Transportation: In the transportation sector 55 percent diesel is imported, which is worth Tk.174.78 billion (FY2005-2006), and 100 percent of octane and 80 percent of petrol respectively are used. But there is a great alternative potential to use domestic **Compressed Natural Gas (CNG)** instead of imported gasoline in the large transportation sector. CNG can provide considerable cost savings to its users in comparison to gasoline users, and it is also environmentally friendly. In a study (sources are mentioned below as *) it has found that the prices of CNG is much lower than that of gasoline so that an individual can expect to save a *minimum* of 75% on fuel consumption after switching to CNG. In some cases, the

savings could go higher than 75% depending upon the make, model and condition of a vehicle. Therefore, anyone spending Tk.10000 per month on imported gasoline would get the same mileage for just Tk.2000 to Tk.3000 on CNG*.

In addition, the use of CNG as an alternative fuel increases the engine life. CNG has no harmful effects on the engine because it has no lead contents, which can increase the life expectancy of a car engine and other vehicles. Similarly, the life expectancy of crankcases also increases because there is no sulfur production during combustion.

Moreover, CNG is a clean burning fuel that reduces vehicle maintenance. Some fleet operators have reduced maintenance costs by as much as 40% by converting their vehicles to CNG. Intervals between tune-ups for natural gas vehicles are extended to a range between 30,000 to 50,000* miles, while intervals between oil changes for natural gas vehicles are dramatically extended anywhere from 10,000 to 25,000* additional miles depending on how the vehicle is used. Furthermore, CNG can increase the performance of a car too. Natural gas gives the same mileage as gasoline in a converted vehicle. Dedicated CNG engines are superior in performance to gasoline engines. In addition, the use of

natural gas in vehicles also carries **environmental benefits** as it emits fewer quantities of pollutants in comparison to any other conventional fuel. For instance, the emissions of carbon monoxide, non-methane organic gas and oxides of nitrogen emissions are lower by 70%, 89% and 87% respectively. In contrast, tailpipe emissions from gasoline-operated cars release carbon dioxide, which contributes to global warming; this is greatly reduced with natural gas.

Thus, we have seen transportation sector can save the major portion of imported gasoline by using CNG while being environmentally friendlier. In this case, the government can promote alternate use of gasoline such as CNG for the transportation sector. For example, the government can implement a program affecting all vehicles engine by converting into CNG, requiring import of CNG vehicle engines, as well as raising the incentives to use CNG.

*Source: High pressure, low price; NEWAGEXtra, September, 16-22, 2005, author: Asifur Rahman Khan and Adnan Khandker

Industry: Bangladesh has an installed electricity capacity of 5,111 megawatt (mw), but only 3,100 mw are produced leaving a daily shortfall of over 2,000 mw*in peak season.

This is the reason why in the last few years Bangladesh has been experiencing a severe power shortage situation. Power shortage has become persistent and has affected the industrial sector very adversely. An essential precondition for industrial development is uninterrupted supply of energy, yet every industry in Bangladesh has to be worried of power shortage. As a result, businesses tend to keep alternate sources of power such as generator to ensure uninterrupted production. Thus, power shortage is affecting industrial growth negatively in every economic sector. Power shortage leads to reduced productivity and production, increased cost of production, thereby limiting the prospects of the affected industries. The use of own generators as an alternative is costlier than grid electricity. Thus, the importance of adequate supply of power to maintain industrial growth cannot be overemphasized. To ensure sustainable economic growth, there is a critical need to reduce the dependency on imported oil, and should give priority of power generation.

Oil prices and the poor: The populist argument is that the increase in oil prices will hurt the poor. For that matter, increase in *any* commodity or service price consumed by the poor will of course hurt the poor given that it will reduce

their purchasing power. Bangladesh did follow a policy of price controls during the early 1970s with disastrous economic consequences. The real issue is not so much as price controls and subsidies to protect the poor, but whether there is a coherent strategy to raise the income of the poor to enable them to exit from the poverty trap. Creating productive employment and income opportunities is the most sustainable way of addressing the poverty challenge, with elements relating to enhancing access to better health, education, water supply, finance and infrastructure playing a far more central role than subsidizing consumption of any single goods or services.

Even so, depending upon the importance of a good or service in the consumption basket of a poor household, one could argue for a targeted subsidy to protect the real income of the poor. However, more detailed analysis would be necessary to determine the amount of subsidy to offset the impact of oil price increases on the poor. Implementing such a targeted subsidy will also require an adequate mechanism to identify the poor and ensure that most of the benefits accrue to them. This approach would be more cost effective than a generalized subsidy for oil that is likely to be regressive in the sense that much of the benefit is

likely to accrue to the non-poor. And if this generalized subsidy is financed through deficit financing from the banking sector that leads to inflation or by reducing spending on health, education and water supply, it is likely that on the whole the poor will be worse off from this policy packet.

Smuggling issues: It has mentioned before that Bangladesh maintains artificially lowest prices of gasoline among the economies of South Asia region, while for example its neighboring country India maintains significantly higher prices of gasoline. The unintended consequence is the huge amount of imported gasoline smuggled illegally to India across Bangladesh' three-side land border to India, every year, which incurs heavy costs on the Bangladesh economy.

For instance, while the international crude oil price has gone up by over 200 percent from 2003 to2005, the domestic prices of kerosene and diesel have increased by only 50 percent while the price of petrol has increased by only 27 percent. Since crude oil accounts for some 60-65 percent of the cost of the final products, it is obvious that there still remains a substantial subsidy. Second, how do Bangladesh oil prices compare with other countries in the South Asia Region (SAR)? This is shown in Table 6.1 below

for the 5 major SAR countries expressed in Bangladesh taka per liter. The data suggests that, except for kerosene (Although, kerosene price was increased FY2005-2006 by substantial amount), domestic fuel prices are highest in India and lowest in Bangladesh even after the price increase of September 2005.

Table 6.1: South Asia Regional fuel price comparison (Taka per liter as of September 2005)

Country	Octane	Petrol	Diesel	Kerosene
India (Kolkata)	67	65	46	14
Nepal	--	63	43	37
Pakistan	64	58	38	34
Sri Lanka	54	52	32	20
Bangladesh	45	42	30	30

Source: The Daily Star Web Edition Vol- 5 Num 497.htm; Oct. 18, 2005. 18, 2005

A newspaper article* reported that it was estimated due to this questionable trend in the border areas and areas close to the border with India, Bangladesh Petroleum Corporation was incurring losses worth Tk.2 crore (Tk.20 million) every day. It may be mentioned that since 1990, the government has been supplying fuel at a subsidized rate to end-users. This partly explains why the Bangladesh Petroleum Corporation has suffered a loss of about Tk.3177.83 crore

in FY2005-2006. Although Bangladesh Rifles (Security forces) are working thorough out the border areas, but forces cannot solve economic issues easily: these should be resolved using economic means. Therefore, government should consider seriously whether supplying fuel with significant subsidy is sustainable.

* The Independent, July 19, 2005; Internet Edition.

Key suggestions: Under considering the above issues now Bangladesh government should consider seriously whether supplying gasoline with significant subsidy is sustainable for the long term. Subsidy itself the impedes sustainable development and economic efficiency. Without economic efficiency target, it would be difficult to gain optimum result for the whole economy. Since Bangladesh has been maintaining gasoline subsidy policy into the economy for the long time, the sudden one-time withdrawal of total subsidy may impart a great shock on the economy. Instead of a sudden one-time subsidy withdrawal, government can reduce gasoline subsidy gradually, but it should complete within a reasonable time frame and the government should have a strong commitment as well. For adopting the subsidy reduction policy, a few key issues may be considered:

- To find alternate sources and usages of fuel, especially those that emphasize exploration and production of natural gas,
- To formulate a clear and transparent energy usage, exploration and production policy,
- To recover the loss of government revenue, gas and electricity prices could be rationalized,
- To protect the real income of the poor, a targeted subsidy policy can be adopted, rather than generalized subsidy policy,
- To protect the poor people’s real income, expenditure on poverty-reduction projects can be increased,
- To protect the environment, energy policy to develop renewable energy sources can be designed.

Above all, if the Bangladesh government can identify domestic alternate sources and usage of gasoline, then the government can avoid the existing pressures on foreign currency, while at the same time making greater use of its domestic resources.

6.3 Suggested directions for follow-up research:

Gasoline subsidies remain a controversial economic issue for developing countries like Bangladesh. It is also a sensitive political issue. On one hand, this subsidy begets inefficiency for the whole economy; on the other hand, withdrawal of gasoline subsidy will likely generate a huge fall of output and income. This study shows how the economic impacts of such economic shocks can be quantitatively measured. It is very important for policymakers to be able to measure the repercussions of gasoline subsidy reduction; that is, how much output as well as income of factors of production and household income would fall. In this way, policy makers can design alternate attempt of measure to anticipate the possible shortfall of income. My investigation in this study can help policymakers weigh the economic costs and benefits before taking decision whether to reduce subsidy. My effort would also be useful to the citizens of Bangladesh, the civil society, as well as think tanks that are interested in measuring the economy-wide impact of gasoline subsidy reduction.

APPENDICES

APPENDIX A. PRIMARY DATA; THE SOURCES OF ECONOMIC SHOCKS

1. Time Period : (FY 2005-2006)

Products	Import (in MT)		Import Cost(in million US$)		Revenue Income (Tk. in crore)	Subsidy
	Refined	Crude	Crude	Refined		
Octane Petrol Diesel Kerosin	1,26,315 1,53,340 22,98,667 4,99,207	13,00,000	552.117 Tk.3750.69 crore	1382.266 Tk.9332.77 crore	9905.63	3177.58

2. Cost of Procurement of Refined Petroleum products per litre.

Products	Cost of Procurement(Tk./liter)	Selling Price(Tk./Liter)
Octan	Tk. 34.030	54.75
Diesel	Tk. 35.114	30.96
Kerosin	Tk. 36.015	51.29
Jet A-1	Tk. 35.742	52.49

3. Sectoral Une of Petroleum Products (in %)

Products	Agriculture	Transportation	Industry	Domestic
Octan	-	100%	-	-
Petrol	-	80%	20%	-
Diesel	24%	55%	12%	9%
Kerosin	-	-	-	100%

4. Contribution to National Exchequre (Taka in Crore)

2005-2006	2004-2005	2003-2004	2002-2003
2620.26	2745.54	3087.27	2766.00

Source : Bangladesh Petroleum Corporation.

APPENDIX B. HOUSEHOLD TYPES AND THEIR DEFINITION

1.Agricultural landless: Rural agricultural households who own no land.

2.Agricultural marginal: Rural agricultural households who own up to 0.49acres.

3.Agricultural small: Rural agricultural households who own between 0.5 and 2.49 acres.

4.Agricultural large: Rural agricultural households who own more than 2.49 acres

5.Non-agricultural poor female-headed: Rural households whose head is female and not engaged in agricultural activities, and who own less than 0.5 acres of land.

6.Non-agricultural poor male-headed: Rural households whose head is male and not engaged in agricultural activities, and who own less than 0.5 acres of land.

7.Non-agricultural rich female-headed: Rural households whose head is female and not engaged in agricultural activities, and who own more than 0.5 acres of land.

8. Non-agricultural rich male-headed: Rural households whose head is male and not engaged in agricultural activities, and who own more than 0.5 acres of land.

9.Urbanilliterate: Urban households whose head has no schooling.

10.Urban low educated: Urban households whose head's education is 'I-V class' (LFS definition).

11.Urban medium educated: Urban households whose head's education is either 'VI-VIII class'. or 'IX-X class' (LFS definition)

12.Urban highly educated: Urban households whose head's education is either 'SSC/HSC' or 'graduate and above' (LFS definition).

APPENDIX C. PERCENTAGE DISTRIBUTION OF SAM HOUSEHOLDS

SAM Households	No of hhlds (%) in the LFS sample	
Ag landless	210	1.5
Ag marginal	2,420	17.3
Ag small	2,434	17.4
Ag large	1,079	7.7
Nag pfhh	220	1.6
Nag pmhh	2,067	14.8
Nag rfhh	30	0.2
Nag rmhh	1,001	7.1
Urban no ed	1,480	10.6
Urban low ed	1,014	7.2
Urban med ed	853	6.1
Urban high ed	1,200	8.6
Total		
14,008	**100.0**	

Sources: derived from 1995-96 LFS in the SAM 1993-94.

APPENDIX D. COMPARISON BETWEEN THE IMPACT OF SAM AND IO MULTIPLIERS

	I-O	sector total	SAM	sector total
AGRAINS	47.27389428		202.3772	
ACROPS	23.11742852		105.1027	
ALIVSTOK	31.14811976		146.2118	
AForest	11.03515961	112.5746	51.38353	505.07528
AFOOD	24.36284349		286.0171	
ATEXTILES	16.16706057		89.46474	
ACHEMICALS	21.10788328		75.08656	
AOTHIND	9.683588192	71.321376	30.31028	480.8787
ACONSTRUCTION	5.331613959		102.7711	
ACOMMUNICATION	5.047094189		35.82993	
ATradeS	57.73753002		221.1349	
ATransS	191.8356266	191.8356	366.0811	366.0811
ASERVICES	12.60862273		185.6262	
CGRAINS	19.6576404		178.3514	
CCROPS	7.518331165		95.92262	
CLIVESTOK	8.736575271		124.91	
CForest	1.469159609		41.81753	
CFOOD	5.715467421		280.7788	
CTEXTILES	6.672041184		96.56904	
CCHEMICALS	26.65644169		117.7082	
COTHIND	15.72005827		65.55459	
CCONSTRUCTION	5.331613959		102.7711	
CCOMMUNICATION	5.676067421		40.29509	
CTradeS	57.79437561		221.3526	
CTransS	191.8383201		366.0862	
CSERVICES	12.64978238		186.2321	
Total	**821.8923397**		**3815.746**	

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